

Evaluation of Potential Air Exposure Pathways at the Quanta Resources Site, Edgewater, New Jersey

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DATE: December 21, 2006

This memorandum has been prepared in response to the request from U.S. Environmental Protection Agency (EPA), Region 2 for ambient air monitoring for arsenic at the Quanta Resources Site ("Quanta Site"). In an e-mail dated November 16, 2006 from Richard Ho/EPA Region 2 to Tim Metcalf/Honeywell International, Inc., EPA has raised concerns about potential air exposure pathways from surface soil at the Quanta Site; specifically, potential exposure to arsenic from wind-blown dust from the Site. EPA has requested that Honeywell establish an ambient air monitoring program and install 5 perimeter air samplers. The EPA requested installing 3 samplers at the fence line between the Quanta Resources property and 115 River Road building and 2 samplers in the play area for the day care center at the River Road building. The EPA also requested that sampling be conducted on a monthly basis approximately over the next year.

The purpose for this memorandum is to provide an evaluation of conditions at the Quanta Site using EPA's Superfund guidance (EPA, 1992) for an air pathway analysis. An initial step in EPA's approach is an evaluation of site data to determine if a potential air exposure pathway is present, and to identify the approach and level of detail needed for the air pathway analysis. The results from this air pathway analysis suggests that the air monitoring program, as requested by EPA Region 2 in its November 16, 2006 e-mail would not be necessary based on its guidance. Further steps for evaluating the potential air pathway that are consistent with EPA's approach for an air pathway analysis are proposed in this memorandum.

Background

An air pathway analysis is a systematic approach using a combination of modeling and monitoring methods to assess actual or potential exposure to air contaminants (EPA, 1992). The primary components of an air pathway analysis are:

- Characterization of air emission sources (including estimating emission fluxes if needed).
- Evaluation of the effects of atmospheric processes on the potential exposure pathway (evaluation of dispersion, dilution and transport of contaminants in air).

- Evaluation of receptor exposure potential (i.e., what concentrations in air could be expected at receptor locations of interest for various exposure periods).

As specified by EPA's guidance (EPA, 1992), an air pathway analysis is conducted in a tiered manner, first using a screening assessment and followed if necessary with an in-depth assessment. A screening assessment is typically based on predictive modeling; conservative predictive models can be used to determine if a site does not have a significant emissions potential and that no further air pathway analysis is required. Predictive modeling can also be used for an in-depth air pathway analysis, if appropriate and representative soil characterization data are used with appropriate models. Other in-depth methods, such as fence line monitoring, can be used if predictive modeling indicates that a more detailed characterization of emissions is warranted.

Evaluation of Site Data

Distribution of Arsenic Concentrations in Surface Soil

The distribution of arsenic concentrations in surface and shallow soils is described in the Preliminary Site Characterization Report (CH2M HILL, 2006). Based on the data presented in that report as well as more recent data collected in October 2006 as part of the Supplemental Remedial Investigation (RI) activities, elevated concentrations of arsenic have been detected in limited areas in soils from 0 to 1 feet in the northwestern corner of the Quanta Site and on Block 93 (Lots 1, 2, and 3). The extent of elevated concentrations in surface soil, estimated using 100 mg/kg and 1,000 mg/kg isoconcentrations, is shown in Figure 1. The isoconcentration contours presented in the attached Figure 1 have been updated to include recent surface soil data collected as part of the Supplemental RI Activities, as well as other historical soil sampling data.¹

As you know, the Edgewater property, located to the north of the Quanta Resources property, was redeveloped in 2002 at which time the removal of arsenic hot spots, the construction of an impermeable liner and the placement of fill, pavement, and landscaped areas was completed. As part of the liner installation and redevelopment at the Edgewater property portions of the access roadway associated with the Edgewater property that runs east to west were extended onto portions of the Quanta Resources property in order to accommodate the development. At the same time the arsenic liner was extended to the south in these areas. Subsequently, a concrete berm extending beyond the liner in these areas was installed along the boundary of the Quanta Resources property between the Edgewater property access road and River Road where the elevation drop towards the south is as much as 12 feet. As shown in the figure, an area with elevated arsenic concentrations approximately 40 feet by 250 feet (less than 0.25 acres) exists immediately to the south of the Edgewater property, adjacent to the arsenic liner and outside of the area covered by the concrete berm.

¹ The highest concentrations detected in the northwest corner of the Quanta Resources property were from samples collected in the Spring of 2002 by other consultants as part of environmental investigations being performed at the Edgewater property. These data were presented in the Final Soil Remedial Investigation Report (Dan Raviv Associates, Inc., July 29, 2002) for the Former Celotex Industrial Park. While these data are presented on the attached Figure 1, the sampling and analysis methodologies are unknown and quality assurance/quality control information for these data is not available for review. Also, these data have not undergone data validation according to Superfund protocols, as required for the Remedial Investigation for this Site.

An additional area of elevated arsenic concentrations approximately 30 feet by 100 feet is located on Block 93 (Lots 1, 2, and 3). The area of elevated arsenic concentrations on the Block 93 parcel is in a partially vegetated area containing rubble piles and broken bituminous concrete. This area does not appear to be used on a regular basis as redevelopment of this property is pending. Concentrations of arsenic in surface soil throughout the remainder of the Site generally were below 13.2 mg/kg, which is the average concentration in historic fill in New Jersey (Appendix D, NJAC 7:26E, Technical Requirements for Site Remediation, 2005).

Comparison with Screening Levels

A screening level for arsenic in surface soil was calculated based on potential emissions of fugitive dust and inhalation exposure by residents. Based on USEPA's equation for calculating particulate emission factors (PEF) and standard default inhalation exposure factors for residential land use, the arsenic concentration in soil corresponding to a target cancer risk of 1×10^{-6} is 924 mg/kg. The PEF calculation and inhalation exposure factors were drawn from EPA's *Soil Screening Guidance* (1996). The screening level is based on the assumption that 924 mg/kg is the average concentration within 0.5 acre (21,780 ft², or square area 147 feet in length on each side). The particulate emission factor was calculated using an "unlimited reservoir" emissions model. This emissions model assumes that the surface material consists of dry finely divided soils. Emissions were calculated using the assumption that very little vegetation (i.e., 1 percent vegetative cover) or non-erodible elements (such as rocks, pebbles or large soil particles) are present on the site surface. These assumptions are highly conservative, and probably significantly overstate the potential for dust emissions from surface soils at the site. The calculations were performed using the Soil Screening Level calculation available from Oak Ridge National Laboratory (http://rais.ornl.gov/calc_start.shtml). The assumptions used in calculating the soil screening level are presented in Attachment 1.

Characterization of Potential Air Pathway

Under current conditions, arsenic concentrations in surface soil over most of the Site resemble average concentrations in historic fill in New Jersey (13.2 mg/kg). Therefore, emissions of particulates into the air, if any, would produce concentrations of arsenic in air that are no different than other urban areas in New Jersey. Higher concentrations of arsenic have been detected in surface soil in limited areas of the site (i.e., an approximate 0.25-acre area in the northwestern corner adjacent to the arsenic liner on the Edgewater property and a 100 ft by 100 ft area on Block 93).

Higher concentrations may be present in subsurface soil (i.e. below 1 foot in depth) elsewhere at the Site. However, if soils at the site remain undisturbed (i.e., there are no invasive activities such as excavation or grading), emissions to the air would occur only from the surface soils.

A conservative (i.e. health-protective) screening level in soil based on potential emissions of fugitive dust and inhalation exposure by residents is 924 mg/kg. This screening level represents the average concentration in soil within a 0.5-acre area corresponding to a concentration in air that represents an inhalation risk of 1×10^{-6} . This screening level is based on the assumption that surface soil consists of dry, finely-divided (powdery) soils.

with very little non-erodible elements (rocks, sticks or vegetation) in the soil.² As stated previously, these assumptions are highly conservative, and probably significantly overstate the potential for dust emissions from surface soils at the site. It also assumes that emissions from soil occur continuously, and that an individual might be exposed to air concentrations of arsenic resulting from these emissions 350 days per year for a 30 year period. As described previously, there is a limited area on the Quanta Resources property, approximately 0.25 acre, where concentrations possibly might be higher than this health-protective screening level. The highest arsenic concentration in surface soil is located in limited area on Block 93 (913 mg/kg) and is lower than the health-protective screening level of 924 mg/kg. Therefore, further evaluation is not needed of the potential air pathway in the vicinity of Block 93.

The presence of concentrations higher than the screening level by itself does not warrant performing a fenceline air monitoring program. However, further evaluation of the emissions potential in the limited area with elevated arsenic concentrations in surface soil may be warranted. Recommendations are presented below for the further steps that may be needed in the air pathway analysis.

Conclusions and Recommendations

EPA Region 2 has requested that a 1-year fenceline air monitoring program be initiated for potential emissions of arsenic in wind-blown dust from the Quanta Site. Based on an evaluation of the Site, using methods for air pathway analysis developed by EPA, we do not believe that a fenceline air monitoring program is warranted at this time. While a baseline fenceline air monitoring is not warranted, air monitoring activities would be conducted as part of remedy implementation, to assure protection of human health during construction or remediation activities that might involve disturbance of soils at the Quanta Site.

An appropriate next step for further analyzing the potential air pathway would involve more detailed characterization of the surface conditions in soil at the Site. The approach for this more detailed characterization is described in EPA's *Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination* (EPA, 1985), and involves the following steps:

- Estimating the aerodynamic size distribution mode (ASDM) of particles in surface soil; this soil parameter is used to develop a more refined estimate of the threshold friction velocity for dust emissions.
- Estimating the fraction of non-erodible elements in surface soil; this parameter is used to refine the estimated threshold friction velocity.
- Estimating the fraction of vegetation covering the surface.

The data used to estimate these parameters could be collected during a site survey. These data can be combined with a more refined air dispersion model (such as Industrial Source Complex Short-Term [ISCST]) to estimate calculate site-specific arsenic concentrations in air.

² In addition, portions of this area are covered with water at various times of the year, which further reduces the potential for dust emissions.

In addition to this site survey, six surface soil samples (from 0 - 6" in depth, or shallower, if feasible) could be collected and analyzed for arsenic, to better define the surface area with elevated concentrations, with respect to potential air pathways from suspension of wind-blown dust.

Based on the available information, collection of these kinds of data to characterize the dust emissions potential is consistent with EPA's approach for air pathway analysis. Ambient air monitoring is not warranted at this time to evaluate potential arsenic emissions to the air from surface soils at the Quanta Site.

References


CH2M HILL. 2006. Preliminary Site Characterization Report Operable Unit 1. Quanta Resources Site, Edgewater, New Jersey.

U.S. Environmental Protection Agency (USEPA). 1985. *Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination*. EPA/600/8-85/002. Office of Health and Environmental Assessment, Washington, DC.

U.S. Environmental Protection Agency (USEPA). 1992. *Overview of Air Pathway Assessments for Superfund Sites (Revised)*. EPA-450/1-89-001a. November 1992.

U.S. Environmental Protection Agency. 1996. *Superfund Soil Screening Guidance: User's Guide, Second Edition*. Office of Solid Waste and Emergency Response, Publication 9355.4-35. Washington, DC.

Attachment 1. Calculation of Soil Screening Level for Inhalation of Fugitive Dust
(http://rais.ornl.gov/calc_start.shtml)



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Soil Screening Guidance Calculator

Equation Values for Inhalation of Fugitive Dust

Particulate Emission Factor Parameter	Value	Noncarcinogenic Parameter	Value	Carcinogenic Parameter	Value
Surface Area (acres)	0.5	Target Hazard Quotient (unitless)	1	Target Risk (unitless)	1.0E-6
City (climate zone)	Philadelphia (VIII)	Exposure Duration (yr)	30	Exposure Duration (yr)	30
Q/C (g/m ² -s per kg/m ³)	87.36898	Exposure Frequency (day/yr)	350	Exposure Frequency (day/yr)	350
Fraction of vegetative cover (unitless)	0.01			Average Lifetime (yr)	70
Mean annual windspeed (m/s)	4.29				
Equivalent threshold value of windspeed at 7m (m/s)	11.32				
Function dependent on U _m /U _t (unitless)	0.0993				

Soil Screening Levels for Inhalation of Fugitive Dust (mg/kg)

Analyte	Cas Number	Inhalation RfC	Inhalation Unit Risk	Particulate Emission Factor	Noncarcinogenic	Carcinogenic
Arsenic, Inorganic	7440382	/epa/toxicity_fnote.htm	4.3E-03 ^a	1.63E+09		9.24E+02

^a Source: Integrated Risk Information System (IRIS)

This site is maintained and operated through a cooperative agreement between the EPA Office of Superfund and Oak Ridge National Laboratory.

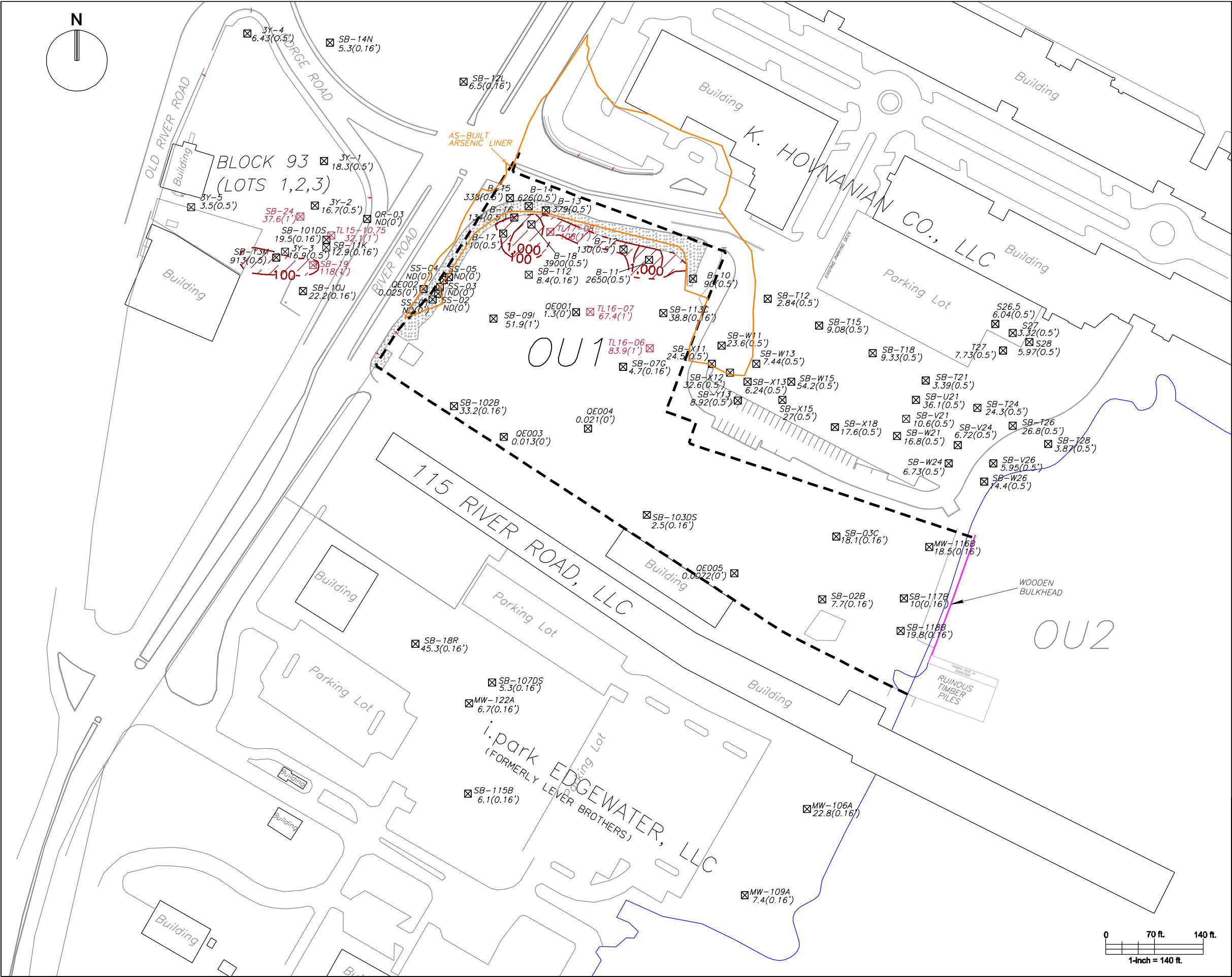
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Last updated on Tuesday, October 24th, 2006

URL: <http://rais.ornl.gov/cgi-bin/epa/ssl2.cgi>



LEGEND

☒
SB-V21
167(0.5')

**SOIL SAMPLING LOCATION
WITH SOIL CONCENTRATION
(mg/kg) & DEPTH (FT.)**

☒
TL16-07
167(0.5')

**SUPPLEMENTAL RI SAMPLING
LOCATION WITH SOIL
CONCENTRATION (mg/kg) &
DEPTH (FT.)**

**CURRENT PROPERTY
BOUNDARY**

**SOIL ISOCONCENTRATION
CONTOUR (mg/kg)**

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**ARSENIC CONCENTRATIONS
IN SOIL >100 mg/kg & <1 FT.
BELOW GRADE**

■

COVERED CONCRETE BERM

NOTES:

1. Lowest soil criteria for arsenic = 0.39 mg/kg [USEPA Region 9 PRG, residential (direct contact)]. The average concentration for arsenic in Historic Fill in New Jersey is 13.2 mg/kg (Appendix D of N.J.A.C. 7:26E, Technical Requirements for Site Remediation, 2005)
2. Soil sampling and analysis methodologies for soil samples collected at select locations in the northwest corner of the Quanta Resources property (B-10 thru B-18) were not available for review. These data were taken from maps prepared by Dan Raviv Associates as part of their letter to the NJDEP regarding remedial efforts at the Edgewater property entitled "Arsenic Hot Spot Removal" and dated September 27, 2002. These data have not been validated and are used only to illustrate potential soil concentrations in these areas.
3. ND = not detected
4. Available historic soil data for the K. Hovnanian Companies, LLC property to the north of the Quanta Resources property is shown but not contoured. These data do not necessarily represent current conditions because of significant filling and disturbances in this area as a result of remedial efforts and redevelopment activities. Soil at this property is being evaluated and addressed with oversight from the NJDEP as part of ongoing redevelopment activities
5. Unvalidated data collected at the K. Hovnanian, LLC property has been included herein for comparative purposes.
6. Depiction of properties adjacent to OU1 does not necessarily mean that site-related constituents have migrated there.

DRAFT



**SOIL ISOCONCENTRATION CONTOURS
ARSENIC (0 - 1 ft.)**

**Quanta Resources Site
Edgewater, New Jersey**

NOVEMBER 30, 2006

FIGURE 1